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**A REVISED CONCEPT OF MORGANELLA, WITH OTHER FORMS
(HOMOPTERA: COCCOIDEA: DIASPIDIDAE)**

By SADAŌ TAKAGI

Abstract

TAKAGI, S. 2007. A revised concept of *Morganella*, with other forms (Homoptera: Coccoidea: Diaspididae). *Ins. matsum. n. s.* 63: 51–65, 6 figs.

The aspidiotine scale insect genus *Morganella*, which has been composed of some species from separate parts of the world in addition to the widely distributed type species, is revised and restricted to three species: *M. longispina*, the type species; *M. polyclena*, a species recently described from the Philippines; and *M. barbatissima*, sp. nov., found on *Cyathostemma excelsa* in Malaya. Thus recomposed, the genus is native to eastern Asia, and the type species should have originated in this region. *Suluaspis rhizophorae*, gen. et sp. nov., associated with the mangrove *Rhizophora apiculata*, and *Acanthaspidotus hibisci*, sp. nov., associated with the littoral plant *Hibiscus tiliaceus*, are described from the Philippines. Both *Suluaspis* and *Acanthaspidotus* are similar to *Morganella* in having thickened marginal setae on the pygidium. *Suluaspis* possibly has some relationship to *Morganella*, whereas *Acanthaspidotus* may not be closely related to *Morganella*.

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Contents. Introduction — *Morganella* — *Morganella longispina* — *Morganella polyclena* — *Morganella barbatissima*, sp. nov. — *Suluaspis*, gen. nov. — *Suluaspis rhizophorae*, sp. nov. — *Acanthaspidotus* — *Acanthaspidotus hibisci*, sp. nov. — Further remarks — References — Figures.

Systematic and Ecological Surveys on Some Plant-parasitic Microarthropods in Southeast Asia, Scientific Report.

INTRODUCTION

The aspidiotine scale insect genus *Morganella* Cockerell as composed by authors (e. g., Ferris, 1938; Balachowsky, 1956; Ben-Dov and German, 2003) is a small group and yet far from uniform in the character pattern of the adult female. The type species, *M. longispina* (Morgan), is remarkable in having thickened and elongate marginal setae and prominent plumose pectinae on the pygidium. It is widely distributed, but it has generally been believed to be native to tropical America (probably because it was originally described from Guyana). Another species, *M. cueroensis* (Cockerell), occurring in southern United States of America and Mexico, differs from the type species in having much shorter marginal pygidial setae and blade-like pectinae, and ‘The assignment of this species to *Morganella* will probably be questioned’ (Ferris, 1938). Five other species, *M. acaciae* Munting, *M. conspicua* (Brain), *M. pseudospinigera* Balachowsky, *M. spinigera* (Lindinger), and *M. vuilleti* (Marchal), all occurring in Africa, do not agree with the type species especially in the pattern of pectinae.

Chou (1985) erected *Sudanaspis* for *M. vuilleti* (spelled ‘*vuilletti*’; =*Aspidiotus* (*Hemiberlesia*) *Vuilleti*), which ‘greatly differs from the type species of that genus [*Morganella*] mainly in the very broad median trullae and digitiform pectinae’ (translated from the Chinese text). In their catalogue of the aspidiotine scale insects Ben-Dov and German (2003) adopted *Sudanaspis* as valid, but left the other four African species and the American *M. cueroensis* in *Morganella*. Afro-American genera are known in the Diaspididae, but *M. cueroensis* is so unique that it does not appear to belong to the same genus as the four African species.

Recently, *Morganella polyclena* has been described from the Philippines (Takagi, 2003). In the present paper, another species, *Morganella barbatissima*, sp. nov., is described from Malaya. Both these species are closely similar to *Morganella longispina* in pygidial features, and I have no doubt that they are congeneric with the latter. These three species apparently represent a natural group, to which *Morganella* should be restricted. Thus recomposed, the genus is native to eastern Asia, and the widely distributed *M. longispina* should have originated somewhere in this region.

Suresh and Mohanasundaram (1996) recorded *Morganella cueroensis* (spelled ‘*Marganiella cueroensis*’), *Morganella longispina*, and another species (‘*Morganella* sp. nov.’) from Tamil Nadu, India. Apparently their concept of the genus was broad, and no recognition characters were given to their new species, of which the generic position therefore is not knowable. (If their identification of *M. cueroensis* is correct, this species was recorded from outside North America for the first time, but they gave no description or figure in support of the record.)

Two new species belonging to two other genera, *Suluaspis*, gen. nov., and *Acanthaspidotus* Borchsenius and Williams, are also described in this paper. Both these genera are characterized, in common with *Morganella*, by having thickened marginal setae on the pygidium. *Suluaspis* is similar to *Morganella* in other characters, too, and thus may have some relationship to the latter, but *Acanthaspidotus* is remarkably different from *Morganella* especially in the arrangement of the dorsal ducts on the pygidium.

connected by intermediate individuals. As stated above, the examined specimens are fairly stable in the number of the pectinae, whereas the other two species of the genus differ from *M. longispina* in having more pectinae. Further material of *M. longispina*, preferably from various parts of the world, may be necessary in order to clarify the exact pattern and meaning of the variation.

Morganella polycltana

Takagi, 2003: 102 [‘Bataan, Luzón, the Philippines, on *Pterospermum diversifolium* (Sterculiaceae)’; ‘Females and males occurring on the lower surface of the leaves, burrowing under the tomentum’].

The adult female of this species (Fig. 2) is peculiar in the dorsal surface of the pygidium, which is not longitudinally striate but thickly strewn with variously shaped sclerotized dots and lines on a broad central area. In this connection, it should be noted that *Morganella longispina* is variable in the dorsal surface of the pygidium, which is striate for the most part or minutely reticulate extensively (see under *Morganella longispina*). In the pygidial fringe *M. polycltana* is very similar to *M. longispina*, from which it differs in having more numerous pectinae (16–19 on each side of the pygidium). It is also characterized by having a larger anus.

Morganella barbatissima, sp. nov.

Material examined. Collected at Kuala Dungun, Terengganu, Malaya, Malaysia, on *Cyathostemma excelsa* (Annonaceae) (identified by K. M. Kochummen), 22 VII 1990 [90ML-293]. Female and male tests occurring on the lower surface of leaves and exclusively on the lateral sides of the midrib. Slide-mounted specimens of the adult female tend to have the pygidium distorted owing to hypertrophy on the ventral side of the pygidium. (So far as the examined specimens are concerned, this hypertrophy seems to be usual in this species). The description below is based on about 10 specimens, which are not or little distorted on the pygidium.

Holotype: adult female, deposited in the collection of Entomology Unit, Forest Research Institute of Malaysia, Kepong, Kuala Lumpur.

Adult female (Fig. 3). Pygidium broadly deltoid, with margin between median trulla and marginal setae of abd IV straight; dorsal surface longitudinally striate for most part. Median trullae with a subapical notch on mesal side and a deeper notch on lateral side; basal scleroses about twice as long as the trulla. Pectinae increasing in size laterally, densely fimbriate on both mesal and lateral sides, 18–22 on each side. Marginal setae of abd IV–VII as long as pectinae occurring nearby, spiniform or slightly flagellate apically. Anus small, situated deeply between basal scleroses of median trullae. Perivulvar disc pores present in 2 groups, which correspond to the anterolateral groups in the usual 4 or 5 group arrangement, 1–7 in each group; at times 1 median disc pore present. Dorsal ducts scattered marginally and submarginally in subapical area of pygidium, 6–9 in total on each side; 1 or rarely 2 ducts medially between basal scleroses of median trullae, opening just posteriorly to anus.

Remarks. This species is easily distinguished from the other two species in the presence of perivulvar disc pores, in the marginal setae of the pygidium not surpassing the pectinae, and in the pectinae more numerous (13 or 14 pectinae occurring in *M. longispina* and 16–19 in *M. polycltana* on each side of the pygidium).

Morganella

Cockerell, 1897: 22 [*Morganella*, n. subg. of *Aspidiotus*; type species: '*maskelli* Ckll. n. sp.' (which has been regarded by authors as identical with *Aspidiotus longispinus* Morgan, 1889)].

The adult females of *M. longispina*, *M. polyclena*, and *M. barbatissima*, sp. nov., are closely similar in the pygidial fringe and other pygidial features as follows. Median trullae appressed together on most of their mesal margins, with their lateral margins convergent and notched once or twice; each trulla basally with a strong sclerosis extending anteriorly; no yoke connecting the trullae. No trace of lateral trullae. Pectinae forming a continuous series on each side of pygidium between median trulla and marginal setae of abd IV; pectinae occurring between median trulla and marginal setae of abd VII small, not exceeding median trullae; pectinae occurring between marginal setae of abd IV and VII prominent, tending to increase in size laterally, spiniform or bifurcate apically, fimbriate with hairy processes on both mesal and lateral sides or only on lateral side. Dorsal and ventral marginal setae of abd VII thickened, nearly as long as the overlapping pectinae, those of abd IV to VI thickened and elongate, tapering apically, as long as or much longer than pectinae occurring nearby. A pair of very small scleroses, confluent at their apical ends, occurring marginally between median trulla and dorsal seta of abd VII, and also between dorsal setae of abd VI and VII. Anus subapical, situated between anterior ends of basal scleroses of median trullae or deeply between the scleroses. Ducts occurring on dorsal surface of pygidium filiform, not distinguishable from microducts in size of orifice; scattered in subapical area of pygidium, a few of them being marginal, others submarginal. Microducts present on ventral surface of pygidium submarginally and on prepygidial segments.

The three species are also very similar in their tests. In both sexes tests black and brittle; female tests rounded and moderately convex dorsally, posteriorly with a broad and short extension curved up; male tests smaller and slender.

Morganella longispina

Morgan 1889: 352 [*Aspidiotus longispinus*]; 'Found on *Cupania sapida* from Demerara', Guyana, South America].

This species has been redescribed and figured by authors, but not all the figures presented by them agree exactly in the details including the number of the pectinae (e.g., Ferris, 1938; Balachowsky, 1948; Balachowsky, 1956; Tang, 1984; Miller and Davidson, 2005). Specimens collected in southern Japan (Sikoku; Kyûsyû; Ryûkyû) on various plants have been examined for the present study. They show some variation in pygidial characters as described below, but agree in having 13 or 14 pectinae on each side of the pygidium.

In one extreme of the variation (Fig. 1), the pygidium is flattish on the margin between the marginal setae of the fourth abdominal segment, its dorsal surface is longitudinally striate except on a narrow median area, which is minutely reticulate, and the marginal setae occurring on the fourth to sixth abdominal segments are all flagellate apically. In the other extreme the pygidium is broadly deltoid, its dorsal surface is minutely reticulate in a broad area, and the dorsal marginal seta of the sixth abdominal segment tends to be straight. Generally, specimens from the same colonies are similar. However, the forms do not seem to be associated with localities or host plants, and are

Suluaspis, gen. nov.

Type species: *Suluaspis rhizophorae*, sp. nov.

Adult female. Body obovoid, growing obpyriform with pygidium somewhat produced. Median trullae appressed together on their mesal margins, with their lateral margins convergent and notched, each with a well-defined basal sclerosis extending anteriorly. No sclerotized lateral trullae; second trullae represented each by a narrowly conical or spiniform process. Pectinae well developed, mostly bifurcate apically, some of them being fimbriate subapically, 2 pectinae between median trulla and process representing second trulla, and a series of pectinae laterally to the process. Marginal setae of abd IV–VII thickened, not surpassing pectinae. No marginal scleroses laterally to median trullae. Anus at apical third of pygidium. Dorsal macroducts of pygidium slender, but not filiform, each with a small orifice; few, scattered marginally and submarginally, tending to be restricted to subapical area of pygidium.

Remarks. This genus is similar to *Morganella* in the median trullae appressed together and with strong basal scleroses, in having well-developed pectinae and thickened marginal setae, and in the dorsal ducts of the pygidium few and tending to occur in the subapical area of the pygidium. It differs from the latter in the persisting second trullae, which, however, are not sclerotized and much modified in shape, in the pectinae not fimbriate with hairy processes, in the anus situated more anteriorly, and in the dorsal ducts of the pygidium slender but not filiform.

Suluaspis rhizophorae, sp. nov.

Material examined. Collected in the Philippines on the mangrove *Rhizophora apiculata* (Rhizophoraceae): White Beach facing on the Sulu Sea, Puerto Princesa, Palawan Island, 14 VIII 1993 [93PL-70]; Abucay on Manila Bay, Bataan Peninsula, Luzón Island, 19 VIII 1994 [94PL-67]. Female and male tests occurring on the lower surface of leaves; female test thin, gently convex dorsally, whitish, tinged with light brown about centre; male test whitish. Described from 8 specimens from Puerto Princesa and 10 from Abucay.

Holotype: adult female, from Puerto Princesa, deposited in the collection of Museum of Natural History, University of the Philippines at Los Baños, Laguna, the Philippines.

Adult female (Figs 4 and 5). Median trullae deeply notched once on lateral side. Second trullae membranous, variable in shape from a narrowly conical lobule to a slender spiniform process. Pectinae occurring laterally to modified second trulla nearly equal in length, 10–12 (usually 11), the mesalmost of them (occurring just laterally to second trulla) always replaced by a slender spiniform process, at times 1–3 other pectinae also spiniform. Dorsal macroducts few; 2 marginal, occurring just mesally to dorsal marginal setae of abd VI and VII; several ducts, up to 5, occurring sparsely in a submarginal zone (in some of the examined specimens no ducts have been discernible in this zone). Perivulvar disc pores absent. Prepygidial lateral macroducts present, much shorter than pygidial macroducts; 1 at times present on metathorax, 1 or 2 (at times absent) on abd I, 2–5 on II, and 1–5 on III. Cephalothorax becoming sclerotized in a broad marginal zone.

Acanthaspidiotus

Borchsenius and Williams, 1963 [type species: *Aspidiotus pustulans* Green, occurring in Java on the bark of *Erythrina lithosperma*].

This genus was erected on the type species alone. *Acanthaspidiotus borchsenii* was

described from Japan (Takagi and Kawai, 1966) but, later, it was transferred to the newly erected *Oceanaspidiotus* and regarded as a form of *O. spinosus* (= *Aspidiotus spinosus* Comstock), which was, thus, interpreted to be a widely variable species (Takagi, 1984). In this paper a new species is referred to the genus. So far as based on the type species and the new species, the genus may be recognized by the combination of the following characters in the adult female.

Median trullae set very close, but not appressed together, nor convergent, each with a well-defined basal sclerosis extending anteriorly. Lateral trullae much reduced in size or almost obsolete. Pectinae occurring segmentally on abd VI–VIII (on which they do not form a continuous series) and between median trullae (on abd IX), spiniform or bifurcate apically. Marginal setae on abd V–VII thickened, spiniform or flagellate apically, exceeding pectinae in length. Dorsal ducts filiform, each with a small orifice; numerous, arranged in 2 or 3 long rows on each side, the rows running nearly longitudinally through pygidium. Anus situated posteriorly to level of vulva.

Remarks. The two species agree especially in the occurrence of the dorsal pygidial ducts in longitudinal rows, and this character is adopted as a diagnostic one, by which the genus is easily distinguished from *Oceanaspidiotus*. The second-instar female and male of *A. hibisci*, sp. nov., show the same arrangement of the ducts, which, however, are fewer. In the second-instar male these ducts are not filiform as in the adult and second-instar females but much broader, thus belonging to the type found in *Aspidiotus* Bouché and many other aspidiotines.

This genus is similar to *Morganella* in having thickened marginal setae on the pygidium, but it may not be closely related to the latter, from which it greatly differs not only in the dorsal ducts (which are disposed as stated above) but also in the median trullae (which are set parallel and not appressed together) and the pectinae (which are not so developed as in *Morganella* and not fimbriate with hairy processes).

Acanthaspidiotus hibisci, sp. nov.

Material examined. Collected at Morong, Bataan Peninsula, Luzón Island, the Philippines, on the littoral plant *Hibiscus tiliaceus* (Malvaceae), 21 VIII 1994 [94PL-88]. Female and male tests occurring on the lower surface of leaves, grayish brown. The description below of the adult female is based on about 20 specimens.

Holotype: adult female, deposited in the collection of Natural History Museum, University of the Philippines at Los Baños, Laguna, the Philippines.

Adult female (Fig. 6). Pygidium broadly deltoid; dorsal surface with a variously reticulate pattern on a broad area on each side. Median trullae notched once on each side. Second and third trullae each indicated by a slight marginal prominence. Pectinae bifurcate apically; 2 small pectinae between median trullae; pectinae occurring on abd VI–VIII short, 2 on each of the segments. Dorsal and ventral marginal setae of abd VI and VII strong, those of abd V also somewhat thickened. Dorsal ducts occurring on pygidium filiform, not distinguishable from microducts in size of orifice, most of them arranged in 2 nearly longitudinal rows on each side: mesal row with 16–27 ducts, arising between median trulla and prominence representing second trulla, and extending anteriorly to subbasal level of pygidium, where the row becomes broader; lateral row with 6–15 ducts, shorter, arising between prominences representing second and third trullae; 1 or 2 (usually 2) ducts marginally between dorsal setae of abd V and VI. A few dorsal ducts occurring submedially on base of pygidium, interpreted to be microducts; submedian

dorsal microducts also present on prepygidial abdominal segments and supposed meta- and prothorax; microducts strewn along body margin, numerous on prepygidial abdomen and thorax, opening on dorsal or ventral surface, also sparsely scattered on head margin; ventral microducts scattered along margin on abd V, anteriorly to anterior spiracles, and laterally to posterior spiracles. Perivulvar disc pores absent. Antennae each with a strong seta.

Remarks. The adult female of the type species, *Aspidiotus pustulans*, was described by Green (1905) ['G' in the following lines] and re-examined by Borchsenius and Williams (1963) ['B and W']. So far as compared with these descriptions, the new species differs from the type species as follows. In *Acanthaspidotus pustulans* the second and third trullae are 'minute' (B and W) and 'with broad base and acuminate apex' (G), whereas in *A. hibisci* the lateral trullae are represented by slight marginal prominences; in *A. pustulans* the pectinae are 'numerous' (G), 'becoming longer anteriorly' (B and W), whereas *A. hibisci* has fewer pectinae, which are about equal in length; in *A. pustulans* the dorsal ducts form three nearly longitudinal rows, of which the middle one becomes broader anteriorly, on each side of the pygidium (according to the figure in B and W), whereas in *A. hibisci* the middle row is less developed and the lateralmost row is reduced to a few marginal ducts. These differences are remarkable, but of quantitative rather than qualitative nature, and I have little doubt that the new species belongs to *Acanthaspidotus*. Furthermore, the new species is readily distinguishable from the type species by the absence of perivulvar disc pores.

FURTHER REMARKS

Morganella longispina is polyphagous and widely distributed in the tropics and warm temperate regions of the world. Authors stated that it should be a native of South America, but seemingly without good grounds. In many parts of the world it has been recorded on fruit trees and other cultivated plants (e.g., Balachowsky, 1956). In the United States of America, 'Through the years it often has been intercepted in quarantine on hosts such as *Citrus* and *Nerium* from various Caribbean islands and South America' (Miller and Davidson, 2005). In general, introduced scale insects, once established, are prosperous in urban or rural environment, and this is probably the case with *M. longispina* in tropical America and other parts of the world.

In Asia, too, *M. longispina* has been recorded from many localities. In spite of this fact and in discordance with my assertion that it should have originated in eastern Asia, I have found no material of this species in my collection from tropical Asia. This may be due to my concentration of surveys on natural vegetation, in which, and especially in deep forests, it was not always easy to find scale insects. The other two species of *Morganella* were collected on wild plants. I came across *Morganella barbatissima* only once throughout my repeated trips in Malaya, and I collected *Morganella polyclena* only in the Bataan Peninsula, whereas its host plant, *Pterospermum diversifolium*, and the genus *Pterospermum* are widely distributed in tropical Asia. I have no doubt that these two species will be found from other localities in eastern tropical Asia, and little doubt that further species of the genus occur in this region.

I do not proceed to the generic positions of the African and American species now excluded from *Morganella*. Although they have been referred to *Morganella* by authors, it does not seem to me that they are particularly closely related to *Morganella*

as understood in the present paper. Among the aspidiotines known to me, *Suluaspis* may be the most noticeable in its possible relationship to *Morganella*. The similarities and differences between the two, mentioned in Remarks under the genus, could be interpreted in terms of ancestral-descendant relationship, though the difference is still too great in the state of the pectinae and also in the development of the thickened setae.

In the Aspidiotini, the occurrence of thickened marginal setae on the pygidium is known in some genera, not all of which are closely related to each other so far as based on other features. *Acanthaspidotus* may not be particularly closely related to *Morganella*, because it is remarkably different from the latter especially in the occurrence of abundant dorsal ducts in longitudinal rows on the pygidium. *Octaspidotus* MacGillivray as understood by recent authors is also characterized by the presence of thickened marginal setae, which are, however, flattened, lanceolate, and hyaline (so that they were overlooked by earlier authors). In consideration of other features, too, *Octaspidotus* has no particular relation to *Morganella*.

The adaptive significance of these thickened setae is unknown. It should be noted that *Suluaspis rhizophorae* and *Acanthaspidotus hibisci* inhabit maritime or littoral vegetation. Spiniform marginal setae also occur in *Oceanaspidotus*, which is widely distributed on Pacific islands (Williams and Watson, 1988).

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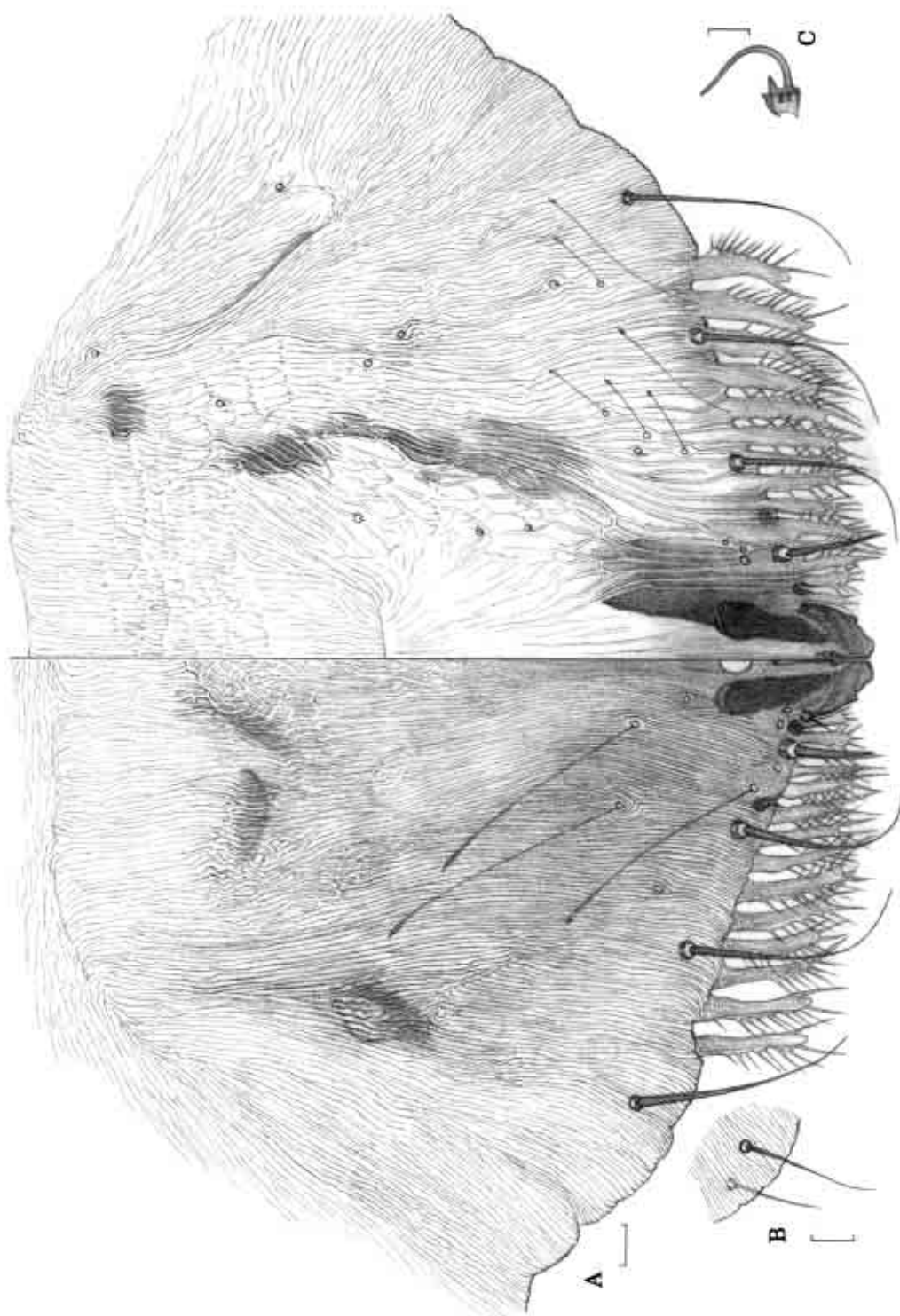


Fig. 1. *Morganella longispina*, adult female: A, pygidium; B, marginal setae on abd III; C, antenna. Nase, Amami-Ōshima, the Ryūkyū Islands, Japan, on *Elaeagnus* sp. Scales: 10µm.

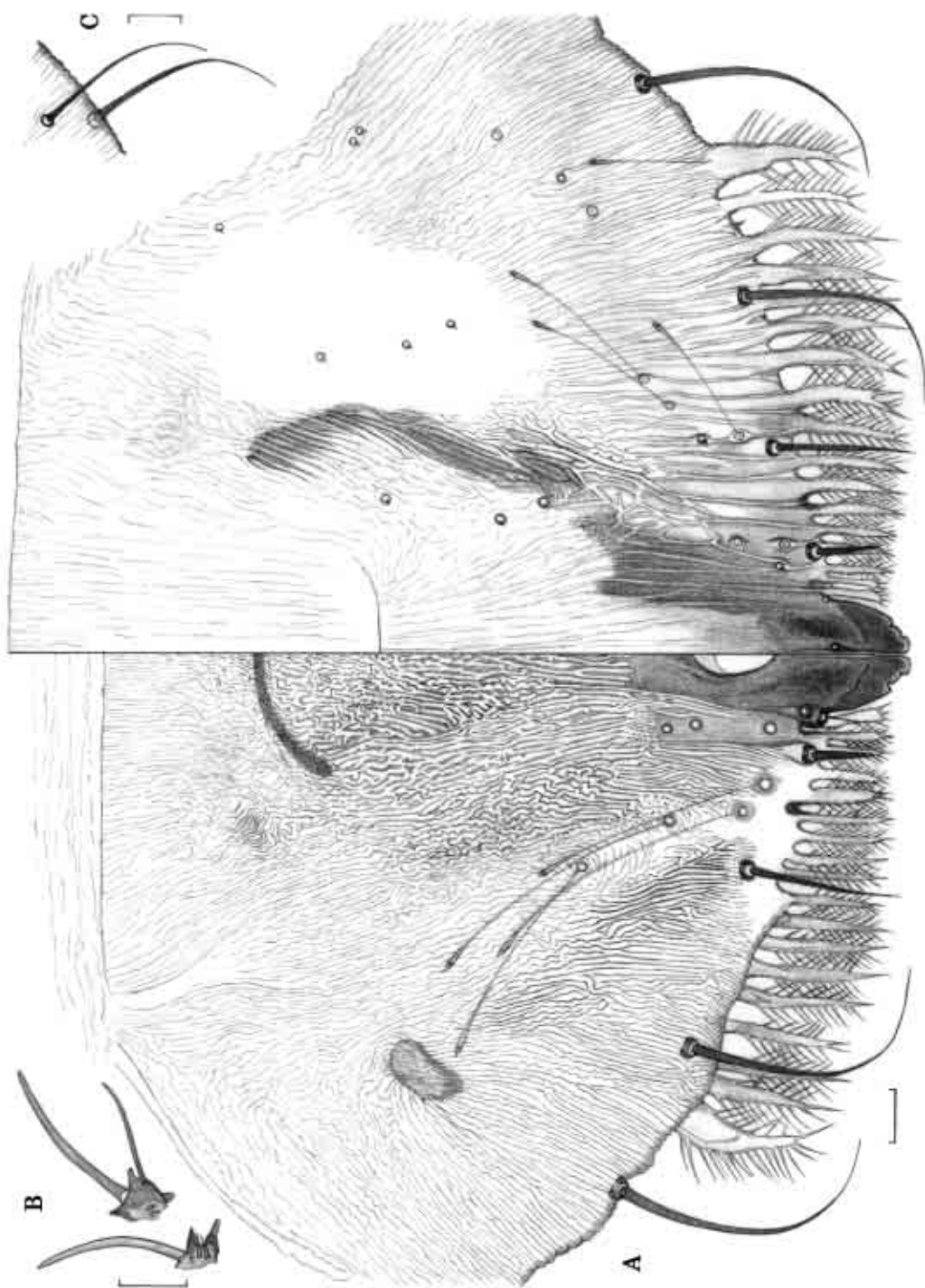


Fig. 2. *Morganella polyclena*, adult female: A, pygidium; B, antennae; C, marginal setae on abd III. Bagac, Bataan Peninsula, Luzón Island, the Philippines, on *Pterospermum diversifolium*. Figured from a young adult female with the basal scleroses of the median trullae not yet fully formed. Scales: 10 μ m. (Reproduced from Takagi, 2003.)

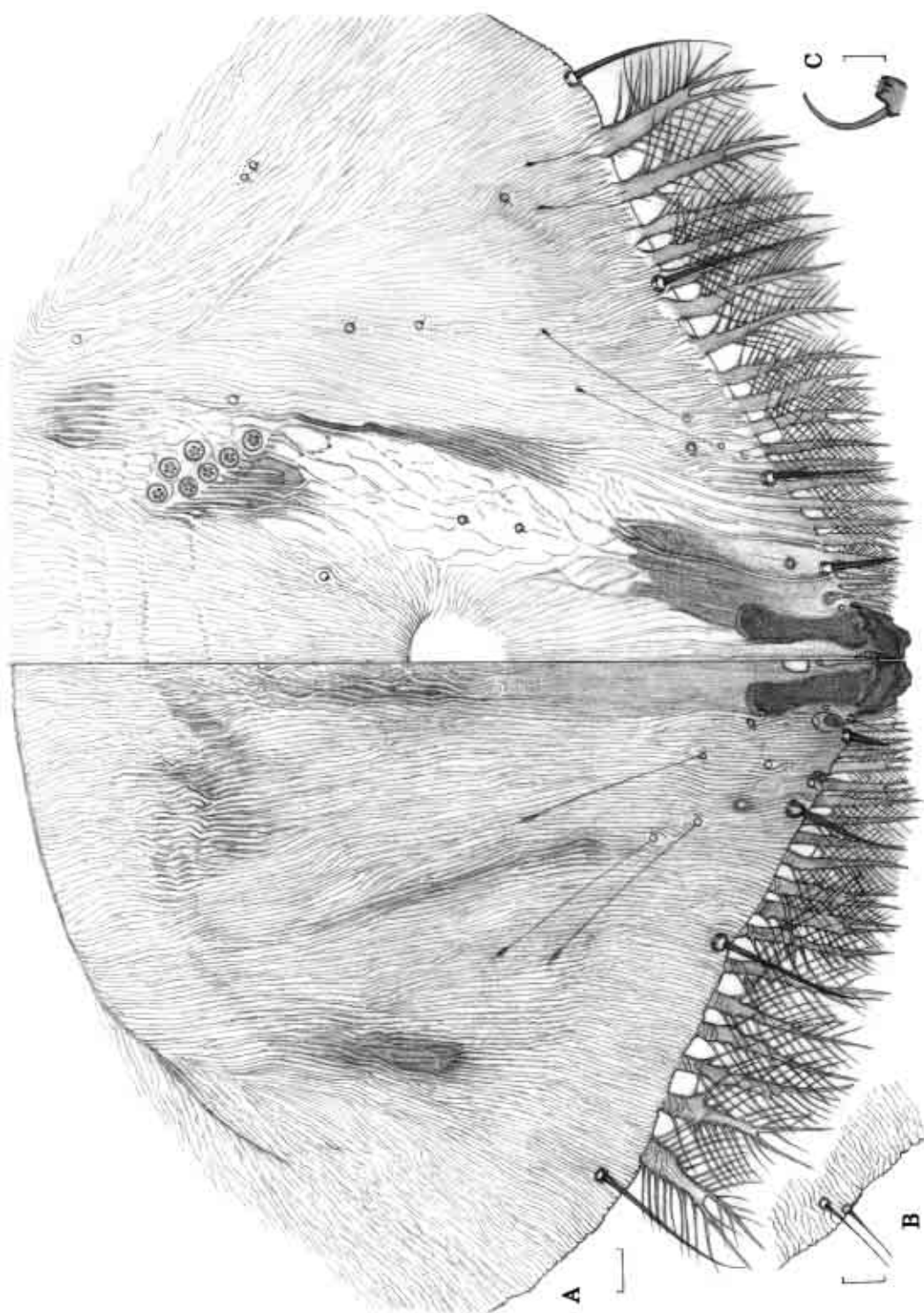


Fig. 3. *Morganella barbatissima*, sp. nov., adult female: A, pygidium; B, marginal setae on abd III; C, antenna. Scales: 10µm.

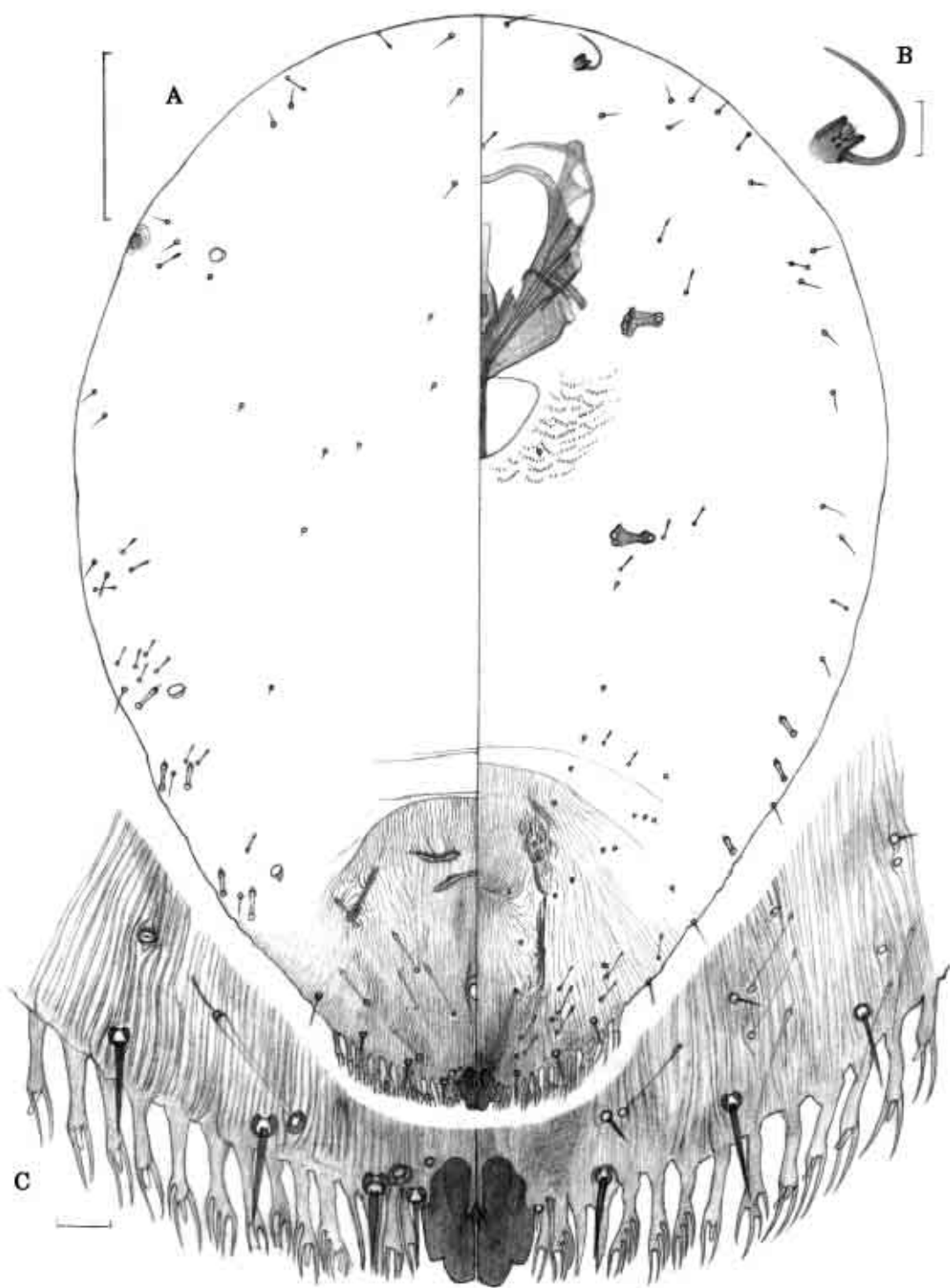


Fig. 4. *Suluaspis rhizophorae*, sp. nov., adult female: B, antenna; C, pygidial margin [93PL-70].
Scales: A, 100 μ m; B and C, 10 μ m.

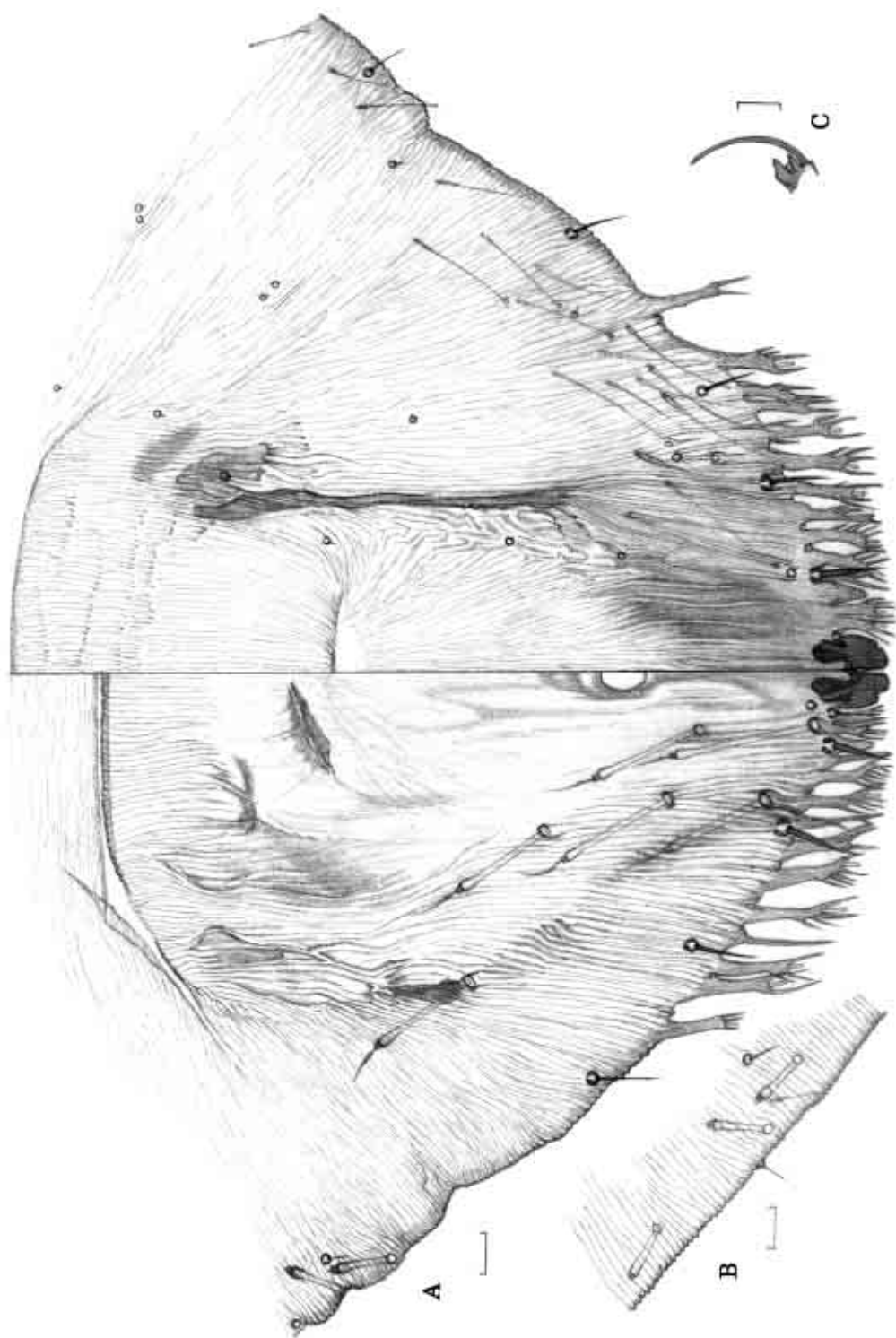


Fig. 5. *Suluaspis rhizophorae*, sp. nov., adult female; A, pygidium; B, margin of abd III; C, antenna [94PL-67]. Scales: 10 μ m.

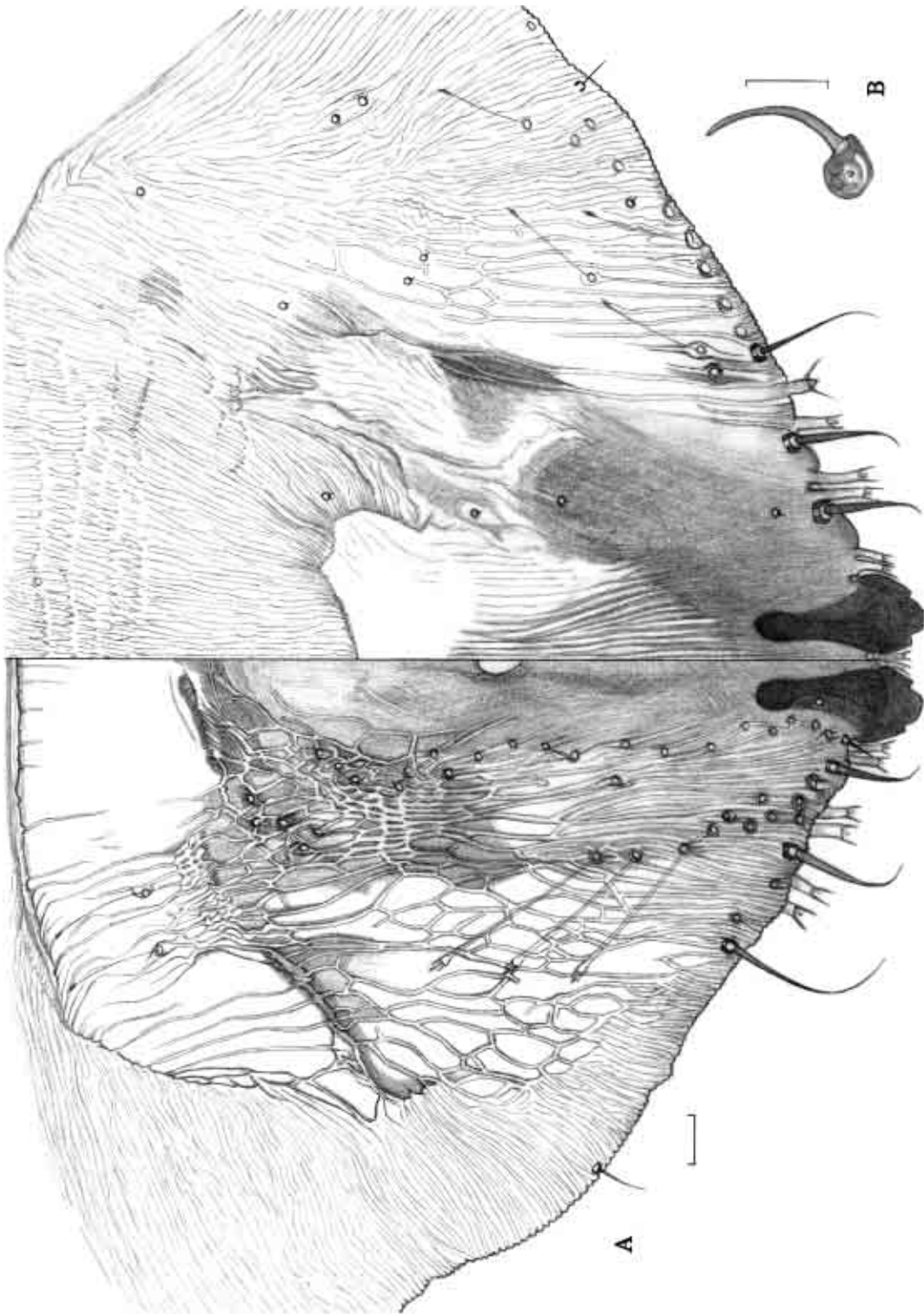


Fig. 6. *Acanthaspidotus hibisci*, sp. nov., adult female: A, pygidium; B, antenna. Scales: 10µm.